AN ANALYSIS

OF THE

MOTOR VEHICLE REPAIR TRADE

· BODY DIVISION ·

PREPARED BY

A NATIONAL COMMITTEE

APPOINTED BY

THE DEPARTMENT OF LABOUR

OTTAWA, CANADA

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AN ANALYSIS OF THE MOTOR VEHICLE REPAIR TRADE

BODY DIVISION

INTRODUCTION

The first National Conference on Apprenticeship in Trades and Industries held at Ottawa in May 1952, recommended that the Federal Government be requested to co-operate with Provincial apprenticeship committees and others concerned in preparing analyses of a number of skilled occupations. In implementing this recommendation, the Vocational Training Branch of the Federal Department of Labour has appointed a number of committees, each of which has compiled an analysis of one trade.

In the case of the Motor Vehicle Repair Trade (Body Division) a committee of two experienced teacher-tradesmen was appointed and the organization meeting was held in Montreal on November 18, 1957. The committee consisted of Mr. W. W. Cale, instructor in the New Brunswick Technical Institute, Moncton, N.B. and Mr. Robert M. Reid, instructor in the Provincial Institute of Technology and Art, Calgary, Alberta and was convened by Mr. S. R. Ross, Supervisor of Trade Training for the Federal Department of Labour, Ottawa, Canada.

Because body repairing is an activity in the motor car field, the committee recommends that a title be used similar to that for the mechanical division of the trade, which was called Motor Vehicle Repair Trade (Mechanical Division).

SCOPE OF THE ANALYSIS

While regulations controlling the Motor Vehicle Repair Trade vary somewhat province to province, techniques are universal and common to all. It was, therefore, only necessary to delimit the scope of the work to be considered as the basis of the body division. Accordingly, the committee decided not to include radiator repairing, frame straightening, wheel aligning and headlight adjusting because these procedures require equipment not universally available in body shops and are generally performed by the mechanical branch of the trade or by specialty shops.

It was finally decided to deal with those phases of the work that are obviously the elements common to all provinces. In other words, it was hoped that this analysis would be acceptable to officials in each province as the basis for the training of competent mechanics. This nevertheless does not preclude the possibility of certain items being added as required by a given province.

It should be noted that this analysis is not a course of study nor is it intended that items be undertaken in the sequence shown. It is, however, a compilation of essential operations which a fully trained journeyman should be able to perform and also sets forth items of related knowledge which he should have mastered. The knowledge is necessary to facilitate the performance of the respective operations and makes for an efficient, intelligent craftsman.

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There are certain features not listed, particularly of an informational nature, but which would be included automatically in a well planned training program. Such items will include the safety of the individual and his fellow workmen in all the varying situations with which they will be confronted and also will stress necessary precautions in the handling of components to guard against damage during storing and assembling. Orderliness and cleanliness, care and use of all hand tools and general shop equipment should be stressed as a matter of routine. The committee wishes to note possibilities for the future in plastic bodies but considers that procedures in this connection are extraneous to this trade at the present time. Likewise no attempt has been made to deal with acrylic finishes.

PROCEDURE

As each committee member compiled a division of the analysis, he referred his work to the others for critical examination. After details were finally agreed upon and edited, proof-copies were prepared and submitted to the Directors of Apprenticeship and others for study and approval. It was felt that this procedure would ensure the validity of each part and would guarantee the national aspect of the whole.

Each of the main divisions comprises a series of Blocks, divided into Units. In turn, each Unit is sub-divided into a number of Operations with related information clearly indicated under the heading, Knowledge.

PURPOSES AND USES OF ANALYSIS

The committee recommends this analysis as a guide to foremen and others who do training on the job; as a basis of programs in industry and for courses of study in vocational schools, trades institutes and other centres; as a yardstick by which the previous experience of newcomers or others may be evaluated.

It is the sincere hope of the committee that this effort will contribute to the nation-wide development of apprenticeship training and will generate real zeal for uniformly expert craftsmanship in this trade.

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Metal Repairing - BLOCK 1 - General Shop Practice

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Block 1 - One Unit

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BLOCK 1: General Shop Practice — UNIT 1: Basic Operations

OPERATIONS	KNOWLEDGE
1. Bench filing as necessary in repair operations	Miscellaneous information and techniques necessary in filing (a) Protection of work from vise marks (b) Necessity of positioning work (c) Pressure of vise on work (d) Need for teeth on edge of file (e) Types of squares (f) Need for chalking the metal (g) Wire brushes and file cards (h) Necessity for draw filing (i) Method of holding a file (j) Necessity of file care (k) Posture of workman when filing (l) Trade specifications of files (m) Number of strokes per minute (n) Pressure on file blade (o) Length of stroke (p) Hardness and temper of files (q) Metal identification
2. Cutting metal to a line (a) Positioning the saw and starting the cut (b) Holding the saw straight (c) Finishing the cut	Technical information on hand hack saws (a) Types and sizes of saw frames (b) Length of saw blades (c) Types of steel used in saw blades (d) Number of teeth per inch (e) Need for different blades (f) Need for correct installation and tension (g) Number of strokes per minute (h) Posture of workman (i) Causes of blade breakage (j) Storage of blade and frame
3. Laying-out as necessary in repair operations (a) Applying lay-out material (b) Marking out dimensions	Details in using lay-out materials (a) Types of lay-out material (b) Types of punches used (c) Types of calipers, dividers (d) Types of hammers, weight, etc. (e) Reading a scale

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BLOCK 1: General Shop Practice UNIT 1: Basic Operations

OPERATIONS	KNOWLEDGE
4. Drilling a hole	Technical details re drill bits and their use
(a) Sharpening a drill bit (b) Testing the cut	(a) Angles of a drill bit (b) Methods of checking the angles (c) Types of steel used (d) Identification of drill bit sizes as to their code of marking (e) Methods used when sharpening a drill bit (f) Necessity of cooling when grinding or using (g) Types of coolant used (h) Pressure required when drilling (i) Advantages of a pilot hole
5. Using an electric drill	Types of electric drills and techniques in using
(a) Connecting up an electric drill (b) Holding an electric drill (c) Triggering the switch	(a) Need for grounding (b) Sizes of electric drills (c) Locking devices on switches (d) Necessity of ascertaining voltage (e) Speed (f) Care of electric drills
6. Using a grinder	Types of grinders and details of operational procedures
(a) Adjusting the work-rest gap (b) Truing up the stone (c) Installing a grinding wheel	(a) Proper gap-clearance for rest (b) Methods of truing stones (c) Necessity of using goggles or head shields (e) Trade specifications for wheels (f) Proper surface speeds

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BLOCK 1: General Shop Practice UNIT 1: Basic Operations

OPERATIONS	KNOWLEDGE
7. Tapping a hole	Technical information on taps and threads
(a) Starting a tap	(a) Types of taps and their care
(b) Checking for straight	(b) Classification of threads - American and English
(c) Turning a tap	(c) Types of turning handles
(d) Breaking a chip	(d) Determining tap-drill size
(e) Tapping a blind hole	(e) Necessity and types of lubrication
(f) Lubricating a tap	(f) Use of thread gauges
8. External threading	Technical information on dies
(a) Starting a die	(a) Size of dies
(b) Checking for square	(b) Types of die handles
(c) Breaking a chip	(c) Necessity of adjustment in some cases
(d) Lubricating a die	(d) Necessity of die extensions
	(e) Thread chasers
	(f) Necessity and types of lubrication
9. Removing a broken stud	Procedures in using extractors
	(a) Types of extractors
	(b) Improvised methods
	(c) Necessity of care
10. Installing a screw	Technical information re screws and screw drivers
	(a) Trade specifications for screws
	(b) Types of screw driver blades
	(c) Care and maintenance of screw drivers
	(d) Types of screw holders
	(e) Use of impact screw driver
11. Using bolts, nuts and washers	Classifications of each
	(a) Trade specifications and terminology
	(b) Special and self-locking nuts and washers
	(c) Various thread systems

BLOCK 1: General Shop Practice UNIT 1: Basic Operations

OPERATIONS	KNOWLEDGE
12. Installing locking devices (a) Locking ring (b) Cotter Key (c) Locking pin	Types and features of locking devices (a) Types of locking rings (b) Methods of installation (c) Specifications of cotter keys (d) Types and sizes of locking pins
13. Hand shearing	Technical details re shearing (a) Use and care of hand shears or snips (b) Types and sizes of hand shears
14. Cutting a panel (a) From the edge (b) From an inside point	Technical details re panel cutters (a) Types of panel cutters (b) Procedures in starting and guiding a cut
15. Using a pair of pliers in the following operations (a) Cutting a piece of wire (b) Clamping a patch (c) Tightening a battery terminal nut (d) Straightening a drip moulding	Technical information re pliers (a) Types of cutting pliers (b) Sizes of slip joint pliers (c) Types of lock-jaw and fender flange pliers (d) Use of battery pliers (e) Use and care of drip moulding pliers
16. Using a punch to (a) Align holes (b) Remove a rusted bolt (c) Make holes in waterproof shims	Technical details re punches (a) Types of punches for aligning (b) Types of punches for starting and drifting (c) Sizes and lengths of punches (d) Sizes of hollow punches (e) Care and use of punches

BLOCK 1: General Shop Practice — UNIT 1: Basic Operations

OPERATIONS	KNOWLEDGE
17. Reconditioning a cold chisel	Technical details re chisels
(a) Sharpening a cold chisel (b) Checking the cutting angle (c) Grinding mushroom end	(a) Types and sizes of chisels (b) Necessity of crowned cutting edge on flat chisels (c) Angle of cutting edge (d) Types of steel used in chisel (e) Necessity of cooling while grinding
18. Replacing a hammer handle	Technical details re hammers
(a) Fitting a hammer handle (b) Installing a wedge	(a) Specifications of hammers (b) Materials used in handles (c) Types of wedges
19. Preparing a soldering iron	Technical details re preparation for soft soldering
(a) Heating (b) Drawing to shape (c) Cleaning the face (d) Tinning the bit	(a) Types and weights of soldering irons (b) Methods of heating and determining temperature (c) Procedure in cleaning and tinning
20. Using a soldering iron to apply soft solder	Techniques of soft soldering
(a) Preliminary cleaning (b) Applying flux (c) Applying solder (d) Cleaning off flux	(a) Methods of cleaning (b) Kinds and corrosion of fluxes (c) Methods of cleaning off fluxes (d) Melting point of solders and composition (e) Purpose of soldering joints
21. Lifting a car	Methods of lifting and securing vehicle
(a) Placing a jack	(a) Types and position of jacks (b) Care and maintenance of jacks (c) Necessity for safety stands (d) Procedures in working under vehicles

Metal Repairing - BLOCK 2 - Oxy-acetylene Welding, Brazing and Cutting

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BLOCK 2: Oxy-Acetylene Welding, Brazing and Cutting

UNIT 1: Cylinders or Tanks

OPERATIONS	KNOWLEDGE
1. Securing cylinders by (a) Fastening same to a wall or cart	(a) Identification of cylinders (b) Necessity of securely fastening cylinders (c) Necessity of apposing outlets (d) Necessity of protecting valves
2. Cleaning tank nipples or outlets (a) Opening valves	(a) Procedure of opening and cleaning outlets (b) Types of wrenches used (c) Number of turns to open valves (d) Purpose of leaving valve wrench in place
3. Checking safety plugs	(a) Location of safety plugs (b) Construction of safety plugs (c) Melting point of safety plugs (d) Release pressure of safety plugs (e) Importance of removing soap after testing safety plugs (f) Danger of using oil or flame in testing any part of the apparatus
4. Handling and storing oxygen and acetylene cylinders	(a) Capacity of cylinders (b) Pressure in both oxygen and acetylene cylinders (c) Requirements of proper storage location (d) Need for care in handling (e) Purpose of porous filter in acetylene cylinder

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BLOCK 2: Oxy-Acetylene Welding, Brazing and cutting

UNIT 2: Regulators and Gauges

OPERATIONS	KNOWLEDGE
1. Installing and Using an oxygen regulator and gauge assembly (a) Checking the tail piece seat (b) Cleaning the tail piece seat (c) Tightening the regulator mounting nut	(a) Purpose of regulators (b) Construction of single stage regulators (c) Type of thread used on oxygen regulators (d) Color identification of oxygen regulators (e) How gas-tight joint is obtained (f) Variations in gauge scales
2. Installing and using an acetylene regulator and gauge assembly (a) Installing a gasket or washer (b) Cleaning the tail piece seat (c) Tightening the mounting nut	(a) Construction of two-stage regulators (b) Safety device used on regulators (c) Type of thread (d) Color identification (e) Variations in gauge scales
3. Checking a diaphragm for leaks	(a) Methods of testing (b) Construction material (c) Causes of leakage

BLOCK 2: Oxy-Acetylene Welding, Brazing and Cutting

UNIT 3: Hoses, Torches and Tips

OPERATIONS	KNOWLEDGE
1. Installing oxygen and acetylene hoses (a) Fastening hoses together (b) Tightening nuts (c) Cleaning interior of hoses (d) Examining hoses for weak places	(a) Sizes of hoses (b) Length of hoses (c) Color identification of hoses (d) Thread identification (e) Necessity of fastening hoses together (f) Hazard in leaks
2. Installing a hose connector by clamping	(a) Use of hose connectors (b) Hazard in using copper tubing (c) Types of hose clamps
3. Installing a welding torch (a) Adjusting valve gland nut	(a) Classification of torches (b) Sizes of torches
4. Installing a torch mixer (a) Placing sealing ring as required (b) Tightening a mixer nut	(a) Width and sizes of sealing rings (b) Models of torches (c) Sizes of mixers (d) Pressure of mixer nuts
5. Installing a tip	(a) Tip sizes (b) Styles of tips (identification) (c) Models of tips with mixers (d) Materials used in tips and mixers (e) Procedure of tightening and angle adjustment of tip
6. Cleaning a tip	(a) Types of tip cleaners
7. Cooling a tip	(a) Procedure of cooling a tip (b) Necessity of cooling a tip

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BLOCK 2: Oxy-Acetylene Welding, Brazing and Cutting

UNIT 4: Flames; Types, Features, Hazards

OPERATIONS	KNOWLEDGE
1. Lighting an oxy-acetylene torch (a) Adjusting the acetylene working pressure (b) Adjusting the oxygen working pressure (c) Using a friction lighter	(a) Procedure of lighting a torch (b) Types of flames (c) How flames are distinguished (d) Temperature of flames (e) Ratio of acetylene to oxygen for various flames (f) Effects of different flames on metal when welding (g) Causes of flame flash back (h) Causes of backfire (i) Necessity of correct flames (j) Necessity of ventilation (k) Necessity of fire protection (l) Danger of excessive rate of discharging acetylene
2. Using goggles	(a) Colors of lenses (b) Lens shade numbers (c) Types of goggles (d) Necessity of proper fit (e) Desirability of disinfecting (f) Need for spacers and clear lens
3. Closing down welding apparatus	(a) Sequence of operations in closing down

BLOCK 2: Oxy-Acetylene Welding, Brazing and Cutting

UNIT 5: Fundamentals of Welding

OPERATIONS	KNOWLEDGE
1. Preparing a job for welding	(a) Necessity of cleaning metal (b) Necessity of clamping work (c) Metal thickness identification (d) Necessity of bevelling heavy metals (e) Procedure for keeping buckling to a minimum
2. Manipulating a torch	(a) Movement of torch (b) Distance of central cone of flame from work (c) Speed of forward movement (d) Puddle formation (e) Angle of tip in relation to work
3. Running a bead (a) Selecting the welding rod (b) Tack welding	(a) Size of beads (b) Sizes and kinds of welding rods (c) Necessity of tacking (d) Pattern of welding rod movement (e) Procedure of welding in different positions (f) Necessity of penetration (g) When to do forehand welding (h) Purpose of backhand welding

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BLOCK 2: Oxy-Acetylene Welding, Brazing and Cutting

UNIT 6: Fundamentals of Brazing and Bronze Welding

OPERATIONS	KNOWLEDGE
1. Brazing a butt joint (a) Cleaning the metal (b) Fluxing the metal (c) Tinning the metal (d) Running a bead (e) Selecting the rod (f) Adjusting the flame	(a) Necessity of cleaning metal (b) Methods of cleaning metal (c) Necessity of spacing and alignment (d) Necessity of fluxing (e) Kinds of fluxes used (f) Procedure of tinning and fluxing (g) Composition of rods (h) Sizes of rods (i) Temperature of brazing operation (j) Types of flames used
2. Bronze welding a crack (a) Preparing by bevelling metal	(a) Necessity of preparation (b) Methods of bevelling metal

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BLOCK 2: Oxy-Acetylene Welding, Brazing and Cutting

UNIT 7: Fundamentals of Cutting

OPERATIONS	KNOWLEDGE
1. Cutting a piece of metal (a) Adjusting the oxygen and acetylene pressures (b) Lighting and adjusting the flame (c) Preheating the metal (d) Starting the cut (e) Cleaning a cutting tip	(a) Types of cutting torches (b) Sizes of cutting tips (c) Pressures used when cutting (d) Styles of cutting tips (e) Distance of flames from work (f) Angles of tip in relation to work (g) Procedure in starting a cut (h) Speed of cutting (i) Terms related to cutting (j) Chemistry of cutting (k) Common faults in cutting

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BLOCK 3: Hardware and Trim

UNIT 1: Glass Channels and Glass Mouldings

OPERATIONS	KNOWLEDGE
1. Installing glass, door or rear quarter	
(a) Checking glass	(a) Types of glass
(b) Removing botton mounting channel	(b) Glass holding device for installing or removing bottom channel
(c) Checking bottom channel for straight	(c) Necessity of checking channel for straight
(d) Cleaning bottom channel	(d) Need of cleaning bottom channel
(e) Installing glass channel tape	(e) Types of glass channel tape
(f) Installing bottom mounting channel	(f) Tension of bottom mounting channel
(g) Installing glass in door or rear quarter panel	(g) Methods of installing glass in door or quarter panel
(h) Adjusting dividing channel	(h) Procedure of adjusting dividing channel
(i) Attaching glass run channel	(i) Methods of shimming run channels
(j) Shimming channels to prevent rattles	(j) Need of cleaning replaceable rubber mounting strip
(k) Installing rubber mounting strip	(k) Necessity of checking for binding
2. Installing glass run channels	
(a) Cutting glass run channels	(a) Types of glass run channels
(b) Drilling or clamping	(b) Need for and method of fastening run channels
3. Installing garnish mouldings	(a) Importance of aligning holes or drilling as required
	(b) Importance of starting all screws before tightening

BLOCK 3: Hardware and Trim

UNIT 1: Glass Channels and Glass Mouldings

OPERATIONS	KNOWLEDGE
4. Installing windshield or rear window	
(a) Cleaning the pinch weld flange	(a) Necessity of cleaning the pinch weld flange
(b) Cleaning the windshield rubber	(b) Need of cleaning the windshield rubber
(c) Installing the glass using a cord	(c) Methods of installation
(d) Applying compounds and sealers	(d) Types of compounds and sealers
(e) Installing locking rubber when used	(e) Methods of locking
(f) Covering painted surfaces, etc.	(f) Protection of finished surfaces
5. Installing quarter window hinge and pivot pin in Convertible and Hard Top	
(a) Attaching the hinge and pin	(a) Procedure of installing
(b) Adjusting the hinge	(b) Purpose of adjustments
	(c) Necessity of adjusting stop
6. Installing windshield and rear window mouldings	
(a) Checking mouldings	(a) Types of mouldings
(b) Soaping the rubber	(b) Procedure of installation
(c) Fastening the moulding	(c) Methods of securing
	(d) Need for installing mouldings at correct time

BLOCK 3: Hardware and Trim

UNIT 2: Locks and Controls (Doors and Windows)

OPERATIONS	KNOWLEDGE
1. Removing door and window regulator handles	
(a) Locating locking device	(a) Types of locking devices
(b) Removing locking device	(b) Use of special hand tools
(c) Removing escutcheon plate	(c) Types of escutcheon plates
2. Installing a window regulator	
(a) Positioning regulator	(a) Types of regulators
(b) Adjusting regulator	(b) Procedure of adjusting
(c) Checking regulator stop	(c) Need for checking stop
(d) Lubricating a regulator	(d) Necessity of lubrication
(e) Attaching glass bottom channel to regulator	(e) Methods of locking regulator arm to glass channel
(f) Checking operation of regulator	(f) Manual control
	(g) Electric Control
	(h) Electric hydraulic control
3. Installing a door lock	
(a) Lubricating a lock	(a) Types of locks
(b) Checking lock operation	(b) Operation of locks
	(c) Types of lubrication
	(d) Necessity of removing other parts
4. Installing remote control	
(a) Adjusting the remote control	(a) Adjustment of remote control
(b) Checking rattle	(b) How to prevent rattles
(c) Checking spring	(c) Types of springs
5. Installing outside safety lock	
(a) Positioning lock	(a) Procedure of installing
(b) Securing in place	(b) Method of locking in handle or body
(c) Checking a lock	(c) Necessity of lubricating
	(d) Kinds of lubricants

BLOCK 3: Hardware and Trim

UNIT 2: Locks and Controls (Doors and Windows)

OPERATIONS	KNOWLEDGE
6. Installing lock barrel	
(a) Checking key number	(a) Location of key number code
(b) Installing parts	(b) Sequence of parts
(c) Securing lock barrel	(c) Methods of securing barrel
7. Installing outside door handle	
(a) Checking door handle	(a) Types of handles
(b) Adjusting a door handle	(b) How to adjust a door handle
(c) Positioning door handle	(c) Procedure of installing
(d) Securing an outside door handle	(d) Methods of locking or attaching
8. Installing a striker plate	
(a) Checking a striker plate	(a) Types of striker plates
(b) Adjusting a striker plate	(b) Position of striker plate
(c) Shimming a striker plate	(c) Need for shims
(d) Lubricating a striker plate	(d) Type of lubrication
9. Replacing a door check	
(a) Fastening a door check link	(a) Types of check links
(b) Positioning a door check link	(b) Adjustment of check link
(c) Lubricating a door check link	(c) Type of lubrication
10. Installing a door hinge	
(a) Positioning a door hinge	(a) Types of hinges
(b) Shimming a door hinge	(b) Purpose of shims
(c) Oiling a door hinge	(c) Type of oil
(d) Straightening a door hinge	(d) Causes of misalignment
	(e) Method of adjusting
11. Installing inside locking button	
(a) Positioning button	(a) Procedure of installing
(b) Adjusting the button	(b) Need for adjusting

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BLOCK 3: Hardware and Trim

UNIT 3: Locks and Controls (Hood)

OPERATIONS	KNOWLEDGE
1. Installing a hood hinge	
(a) Positioning hood hinge (b) Adjusting a hood hinge (c) Tightening hood hinge bolts (d) Sealing hood hinge holes (e) Shimming hood hinge	(a) Types of hinges (b) Need for adjustment (c) Method of adjustment (d) Necessity of sealing (e) Purpose of shims (f) Need of lubrication
2. Installing hood catch hook	
(a) Centering hood catch hook (b) Checking catch hook operation (c) Releasing catch hook	(a) How to center catch hook (b) Need for checking operation (c) How to release
3. Installing hood lock release	
(a) Checking hood lock release (b) Adjusting hood lock release (c) Lubricating hood lock release	(a) Location of hood lock release (b) Adjustment of hood lock release (c) How to lubricate
4. Installing hood dowel, spring and retainer	
(a) Adjusting hood dowel (b) Centering hood dowel (c) Locking hood dowel	(a) Adjustment of hood dowel (b) Procedure of checking for center (c) Need for locking
5. Installing and adjusting hood guide plate	(a) Purpose and methods of adjustment
6. Installing hood bumpers	
(a) Checking hood bumpers	(a) Location of hood bumpers (b) Purpose of hood bumpers

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BLOCK 3: Hardware and Trim

UNIT 4: Locks and Controls (Luggage Compartment and Fuel Opening)

OPERATIONS	KNOWLEDGE
1. Installing hinges on luggage compartment	
(a) Positioning hinges (b) Checking spring tension (c) Aligning gasket (d) Shimming a hinge	(a) Types of hinges (b) Types of springs (c) Procedure of installing (d) Need for shims for proper fit
2. Installing luggage compartment lock	
(a) Positioning lock (b) Checking lock operation (c) Positioning lock bar (d) Increasing or decreasing the luggage compartment door tension	(a) Types of locks (b) Operation of locks (c) Types of lock bars (d) Need for changing tension
3. Installing and checking luggage compartment check link	(a) Types of check links
4. Removing luggage compartment locking handle and lock cylinder	
(a) Removing handle holding device (b) Removing cylinder locking device	(a) Types of holding devices (b) Types of cylinder locking devices
5. Installing hinge on glove compartment and fuel filler	
(a) Checking and adjusting (b) Positioning the door or fuel cover (c) Increasing door tension (d) Unlocking glove compartment door (e) Installing rubber bumpers	(a) Types of hinges and springs (b) Need of spacing for door (c) Procedures in adjusting (d) Types of locking devices (e) Shapes of bumpers

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BODY DIVISION

BLOCK 3: Hardware and Trim

UNIT 5: Body Mouldings, Bumpers, Grille

OPERATIONS	KNOWLEDGE
1. Installing mouldings	
(a) Centering moulding fasteners	(a) Types of moulding fasteners
(b) Drilling a hole in body	(b) Size of moulding fasteners
(c) Sealing moulding fasteners	(c) Need for sealing
(d) Filing a moulding	(d) Types of material
2. Installing bumper arms and blade	
(a) Assembling sections	(a) When and how to assemble
(b) Installing bumper arms	(b) Alignment of bumper arms
(c) Tightening bumper blade	(c) Procedure of tightening
(d) Enlarging a hole by filing	(d) Type of steel
(e) Checking grille guards	(e) Alignment of grille guards
3. Installing grille	
(a) Assembling sections	(a) When and how to assemble parts
(b) Checking assembly	(b) Alignment of parts
(c) Tightening fasteners	(c) Procedure of tightening
(d) Listing parts	(d) How to distinguish parts
(e) Drilling a hole	(e) Types of metal

Metal Repairing - BLOCK 4 - Techniques of Shaping Metal

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BLOCK 4: Techniques of Shaping Metal UNIT 1: Fundamental Procedures

OPERATIONS	KNOWLEDGE
1. Analyzing the job to determine (a) Location of direct damage (b) Location of indirect damage (c) Location of ridges and V-channels	(a) Importance of direction of damaging force
2. Preparing for the straightening operation	(a) Necessity of removing deadener and foreign materials (b) Need for removing parts that interfere with the straightening operation
3. Unlocking the metal	(a) Purpose of unlocking the metal (b) Procedure used in unlocking the metal (c) Tools required to unlock ridges
4. Straightening metal	(a) Procedures used to straighten metal (b) Specifications of hammers used (c) Types and lengths of picks used (d) Types and shapes of punches used (e) Procedure of using hydraulic wedge (f) Necessity of using hydraulic jack
5. Bumping metal	(a) Specifications of bumping hammers (b) Care of hammers (c) Use of impact tool
6. Dinging metal	(a) Specifications of dinging hammers (b) Care of dinging hammers (c) How to use a dinging hammer (d) Shapes of dolly blocks (e) Purpose of dolly blocks (f) How to use a dolly block (g) Need of keeping dolly blocks and hammers clean and free of nicks

BLOCK 4: Techniques of Shaping Metal UNIT 1: Fundamental Procedures

OPERATIONS	KNOWLEDGE
7. Locating high and low areas by	
(a) Sighting	(a) Advantage of proper lighting
(b) Feeling	(b) Procedures in locating high and low areas by hand
(c) Sanding	(c) Methods of using disc sander to locate high and low areas
(d) Cross filing	(d) Objections to excessive cross filing
(e) Using the straight edge	(e) Straight edge method of locating high and low areas
8. Checking curvature of metal	(a) Procedures in checking curvature (b) Need of checking curvature
9. Aligning parts	(a) Need for aligning parts to prevent interference (b) Importance of aligning parts to body profile
10. Shrinking metal	
(a) Preliminary	(a) When to shrink metal (b) Where to start shrinking operation (c) Disadvantage of too many shrink spots (d) Cause of buckling and warping after shrinking (e) Effects of shrinking on metal (f) Necessity of having bulge form outward
(b) Heating metal	(a) Type of heating equipment used (b) Size of tip to use (c) Size of spot to heat (d) Disadvantage of large flame (e) Purpose of dealing with one spot at a time (f) Distance of central cone from metal (g) Care not to burn hole in metal (h) Correct type of flame to use (i) Disadvantage of wrong flames (j) Metal temperature indicated by color

BLOCK 4: Techniques of Shaping Metal UNIT 1: Fundamental Procedures

OPERATIONS	KNOWLEDGE
10. Shrinking metal (cont'd)	
(c) Upsetting metal	(a) Type of hammer used (b) Weight of hammer used (c) Weight of blow to upset (d) Need for tapping down rim (e) Type of dolly block used (f) Disadvantage of excessive hammering
(d) Quenching metal	(a) Need of waiting till redness leaves before quenching (b) Advantage of sponge and water cooling (c) Air cooling
11. Welding a crack	(a) Fundamentals of oxy-acetylene welding (See Block 2)
12. Brazing a joint	(a) Fundamentals of brazing (See Block 2)
13. Finishing metal by sanding	
(a) Holding sander at proper angle (b) Installing sanding disc (c) Attaching sanding pad	(a) Finishing procedure (b) How to use disc sander properly (c) Disadvantages of using edge of sander (d) Trade specifications of sanding discs (e) Methods of tightening sanding discs (f) Types and sizes of sanding pads (g) Advantage of using large disc on small pad (h) Sizes and speed of sanders (i) Advantage of using cone pad and cone shaped sanding paper in some cases (j) Accident prevention (k) Care of sanders
14. Finishing metal by picking up low areas	(a) Types and length of pick hammers (b) Advantage of having pick removable from hammer (c) Care of pick hammers (d) How to use pneumatic pick hammer (e) Air pressure required to operate pneumatic pick hammer (f) Need of lubricating pneumatic pick hammer

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BLOCK 4: Techniques of Shaping Metal UNIT 1: Fundamental Procedures

OPERATIONS	KNOWLEDGE
15. Finishing metal by filing	(a) Purpose of filing (b) Trade specifications of files (c) Pressure required on file blade (d) Types of file holders (e) Use and care of files (f) Need of adjustable holder (g) Necessity of cross filing
16. Applying hot filler	(a) Need for body filler (b) Composition of body filler (c) Melting temperatures of body filler
(a) Cleaning metal	(d) Methods of cleaning (e) Need of clean surface
(b) Tinning metal	(f) Methods of tinning (g) Reason for tinning (h) Types of heating equipment (i) Need of keeping metal warm
(c) Heating filler	(j) State of body filler when applied
(d) Greasing or lubricating the paddle	(k) Types of grease or lubricants used
(e) Paddling filler	(l) Composition of paddles (m) Shapes of paddles (n) Disadvantage of overheating filler (o) Results of overheating metal (p) Results of excessive paddling of filler (q) Causes of pin holes in filler
(f) Finishing filler	(r) Angle of file in relation to work when finishing (s) Need of wrapping file with emery cloth in some cases

OPERATIONS	KNOWLEDGE
17. Applying cold filler	
(a) Preparing metal	(a) Kinds of plastic and other metal fillers
(b) Mixing cold filler	(b) Procedure of mixing
(c) Measuring hardener	(c) Quantity of liquid hardener used
(d) Measuring hastener	(d) Quantity of liquid hastener used
(e) Applying filler	(e) Methods of application
(f) Applying heat	(f) Necessity of heat and some fillers (g) Need of proper preparation (h) Advantages of cold fillers (i) Materials cold filler can be used on (j) Length of time fillers take to harden
(g) Finishing filler	(k) Procedure of finishing
18. Using chopped fiberglas filler	
(a) Cleaning metal	(a) Need of proper cleaning (b) Size of area to be prepared (c) Methods of cleaning
(b) Setting area down	(a) How to set area down (b) Amount to set area down to insure proper contour
(c) Mixing filler and hardener	(a) Amount to mix at one time (b) Need of mixing special filler or fiberglass thoroughly with hardener (c) Need of fiberglas for strength (d) Where "gel coat" can be used
(d) Applying filler (e) Heating	(a) How to apply filler (b) Need of preheating metal (c) Length of time to preheat metal (d) Method of heating (e) Disadvantage of overheating (f) Effect of open flame

OPERATIONS	KNOWLEDGE
19. Using fiberglas cloth to patch hole	(a) Reason for cutting cloth with weave (b) Size of patch to allow sufficient overlap (c) Number of patches required to build up area
(a) Cleaning metal	(a) Procedure of cleaning (b) Size of area to be cleaned (c) Methods of cleaning
(b) Mixing resin, hardener and special filler	(a) Proportion of resin and hardener for size of patch (b) Amount of special filler added to mix (c) Need of keeping containers closed (d) Pot-life of mix
(c) Applying patch	(a) Need for layers of fiberglas cloth (b) Reason for saturating with mix (c) Necessity of removing mix from tools, skin, clothing, etc., immediately (d) How to remove mix from tools, skin, clothing, etc. (e) Method of backing up patch for support till hard
(d) Heating	(a) Need of preheating metal (b) Necessity of preheating materials (c) Length of time to preheat (d) Purpose of heating patch (e) Results of not heating (f) Distance to keep heat lamp (g) Results of overheating
(e) Finishing	(a) How to grind repaired area (b) Grit number of sanding disc to use (c) Procedure of filing

BLOCK 4: Techniques of Shaping Metal UNIT 1: Fundamental Procedures

OPERATIONS	KNOWLEDGE
20. Estimating	
(a) Checking damaged area (b) Deciphering identification tag (c) Listing new parts necessary (d) Listing materials (e) Listing time required to install or repair	(a) Extent of damage (b) Identification of makes and models of vehicles (c) Nomenclature of panels and sections (d) Cost of materials (e) Cost of labor (f) Availability of parts or panels, new or used (g) Procedure of repairing

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BLOCK 4: Techniques of Shaping Metal UNIT 2: Hydraulic Power Units

OPERATIONS	KNOWLEDGE
1. Analyzing the job	Refer to Block 4, Unit 1, Operation 2
2. Preparing for the straightening operation	Refer to Block 4, Unit 1, Operation 2
3. Unlocking the metal	Refer to Block 4, Unit 1, Operation 2
4. Pushing out damaged area	
(a) Positioning hydraulic ram (b) Connecting attachments	(a) Procedure of pushing out damaged area (b) Hook-ups that can be used when pushing out damaged areas (c) Care of attachments (d) Need for care to prevent stretching metal
5. Spreading damaged area by using	
(a) Hydraulic wedge	(a) Sizes of hydraulic wedges (b) Types of hydraulic wedges
(b) Various attachments on hydraulic ram	(c) Hook-up of attachments for spreading with hydraulic ram
(c) Solder plates	(d) How to use solder plates
(d) Stretch clamps	(e) Advantage of using stretch clamps
6. Pulling out damaged area by using push ram	
(a) Installing attachments	(a) How to connect attachments for pulling with spoon and chain (b) How to connect attachments for pulling with blocking and chain (c) How to connect attachments for two-way pulling with chains (d) Care of chains
(b) Anchoring power unit	(e) How to anchor power unit (f) Where to anchor power unit

BLOCK 4: Techniques of Shaping Metal UNIT 2: Hydraulic Power Units

OPERATIONS	KNOWLEDGE
7. Pulling out damaged area by using pull ram	
(a) Connecting attachments	(a) How to connect pulling combinations (b) Attachments that can be used when pulling
(b) Applying corrective force	(c) Where to apply correcting force
8. Clamping	
(a) Connecting attachments	(a) How to connect attachments for clamping (b) Need for clamps (c) Size of clamps
(b) Tightening clamp	(d) Pressure of clamp
9. Filling pump and ram with oil	
(a) Removing filler plug	(a) Specifications of hydraulic power units (b) Tonnage of hydraulic power units
(b) Checking oil level	(c) Quantity of oil required (d) Need of proper oil
10. Removing and connecting hose	(a) Construction of hose (b) Size of hose (c) Types of connections (d) Care of hose
11. Connecting extensions	
(a) Installing threaded extensions	(a) Length of solid extensions (b) Length of adjustable extensions (c) Method of tightening threaded extentions (d) Diameter size of extensions (e) Care of threads
(b) Installing lock-on extension	(f) Types and sizes of lock-ons

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BLOCK 4: Techniques of Shaping Metal UNIT 3: Panel Replacement

OPERATIONS	KNOWLEDGE
1. Ordering panels	(a) Identification of vehicle (b) Identification of whole panel (c) Identification of panel section (d) Identification of slip-on type panel
2. Removing panels	
(a) Removing parts (b) Locating panel joints (c) Removing body fill (d) Cutting tack welds (e) Cutting panels	(a) Necessity of removing parts (b) Location of panel joints (c) Procedure of removing joint fill (d) How to cut tack welds (e) Reason for drilling and breaking tack welds (f) Advantage of using saws to cut panels (g) Types of saws used to c ut panels (h) Disadvantage of using some panel cutters (i) Disadvantage of sectioning panel with cutting torch (j) Advantage of using disc sander to aid in removing some panels
3. Installing panels	
(a) Positioning panels (b) Clamping panels (c) Tack welding panels (d) Filling joints (e) Sealing panels (f) Replacing parts	(a) Need for alignment (b) Types of clamping devices (c) Purpose and methods of tack welding (d) Procedure of filling joints (e) Necessity of sealing (f) Sequence of installing parts

BLOCK 4: Techniques of Shaping Metal UNIT 3: Panel Replacement

OPERATIONS	KNOWLEDGE
4. Applying deadener	
(a) Applying sheet deadener	(a) Purpose of deadener (b) Type of cement used (c) How and where applied (d) Need of clean surface
(b) Applying fiberglass deadener	(a) Thickness of material (b) Type of cement used (c) Reason for using fiberglass
(c) Applying deadener compound	(a) Thickness of coating applied (b) Method of application (c) Solvent necessary to clean finished surfaces (d) Protection of finished surfaces (e) Reason for not using flame near compound

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BLOCK 4: Techniques of Shaping Metal UNIT 4: Body Alignment

OPERATIONS	KNOWLEDGE
1. Checking major body alignment	(a) Need of checking for broken or cracked welds (b) Effect of misalignment on door fit (c) Effect of misalignment on windshield fit (d) Effect of misalignment on rear window fit (e)Importance of checking chassis or frame (f) Necessity of checking body sills
2. Correcting major body alignment	(a) Need of removing part of damage before taking diagonal measurements in some cases (b) Why it is necessary to remove parts (c) What parts to remove (d) Identifying measuring points (e) Height of measuring points (f) Points to X-check (g) What tool to use when X-checking (h) Direction to move damaged section (i) Necessity of going beyond original location (j) Purpose of normalizing (k) Necessity of rechecking measurements (l) Purpose of rechecking welds (m) Methods of transferring measurements (n) Need of using parts or template to check fit
3. Checking curvature of door	(a) Need of checking door fit (b) Where to check door fit (c) Steps in increasing or decreasing door curvature (d) Where to install door bar and clamps (e) Use of blocks to increase or decrease door curvature

Upholstery Maintenance - BLOCK 5 - Installation and Care of Upholstery

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BLOCK 5: Installation and Care of Upholstery

UNIT 1: Miscellaneous Procedures

OPERATIONS	KNOWLEDGE
1. Removing head lining	(a) Types of trim (b) Procedure of removing (c) Need of removing rear glass in some cases (d) Necessity of removing windshield in some cases (e) Proper use of head lining tool (f) Methods of fastening trim
2. Installing head lining	(a) Necessity of checking curvature of roof bows (b) Need of marking roof bows when removed from lining (c) Need of listings (d) Methods of attaching roof bows to side rail (e) Types of nailing strips (f) Methods of fastening nailing strips (g) Weight of tacks (h) Need of trimmer's hammer (i) Types of cement (j) Cause of cement bleeding (k) Methods of holding cloth fastening device (l) Procedure of installing head lining (m) Need of stretching trim (n) Methods of removing sag in trim
3. Removing door trim panel	(a) Methods of attaching (b) Procedure of removing (c) Types of fastening devices (d) Need of care when unlocking fastening device
4. Installing door trim panel	(a) Need of padding under trim (b) Types of trim (c) Purpose of covering on door under trim panel (d) Method of replacing nails on trim panel (e) Procedure of installing

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BLOCK 5: Installation and Care of Upholstery

UNIT 1: Miscellaneous Procedures

OPERATIONS	KNOWLEDGE
5. Installing seat springs	(a) Types of springs (b) Necessity and methods of tying springs together (c) Tension of springs (d) How to prevent sagging of seat
6. Installing seat padding and covering	(a) Need of burlap on some seats (b) Advantage of sponge rubber (c) Types of padding (d) Purpose of hog rings (e) Need of special pliers for hog rings (f) Types of seat covering
7. Ordering trim	(a) Makes and models of vehicles (b) Location of identification plate (c) Trim number or letter
8. Installing seat covers	(a) Types of material (b) Disadvantages of some types of seat covers (c) Methods of fastening covers
9. Repairing trim	(a) Thread gauge by number (b) Colors of thread (c) Kinds of thread (d) Sizes of needles (e) Advantage of curved needle (f) Kinds of tape (g) Methods of applying tape (h) Colors of tape

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BLOCK 5: Installation and Care of Upholstery

UNIT 2: Cleaning Techniques

OPERATIONS	KNOWLEDGE
1. Using vacuum cleaner	(a) Sizes of vacumm cleaners (b) Types of vacuum cleaners (c) How to install and use vacuum cleaner accessories (d) Necessity of maintaining a clean machine within (e) How to use blower connection and sprayer for applying soap solutions (f) Advantage of having accordion type hose
2. Cleaning upholstery	(a) Basic principles of cleaning (b) Advantage of using Turkish towel material (c) Mechanical tools necessary
3. Using cleaning solvents	(a) Necessity of ventilation (b) Need of care to avoid damage to fabrics (c) Reasons for avoiding excessive use of solvents (d) Danger of softening deadener by excessive solvents (e) Safe cleaner to use on complete cleaning job (f) Proportion of water and solvent for cleaning (g) Reason for raising heavy foam
4. Removing stains	(a) Identification of stains (b) Disadvantage of using liquids on mud and certain stains (c) Advantage of using boiling water on beverage stains (d) Advantage of using scraper on confectionery stains (e) Advantage of using alkali on acid stains (f) Advantage of using dry cleaning solvent for grease stains on cloth (g) Disadvantage of using dry cleaning solvent on vinyl (h) Advantage of using vaseline to assist removal of cosmetics (i) Disadvantage of using acetone on rayon acetate material when removing cosmetics

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Refinishing - BLOCK 6 - General Shop Practice

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Refinishing - BLOCK 6 - General Shop Practice

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BLOCK 6: General Shop Practice UNIT 1: Spray Gun

OPERATIONS	KNOWLEDGE
1. Handling the spray gun	(a) Types of spray guns (suction and pressure feed) (b) Proper air pressures (c) Lack of economy due to improper manipulation (d) Proper distance from panel (e) Proper angle (f) Parallel strokes (g) Proper overlap of strokes and speed (h) Need for releasing trigger at the end of each stroke (i) Importance of uniform film thickness (j) Cause and results of improper atomization
2. Cleaning and maintaining the spray gun and hoses	(a) Parts and materials used in the manufacture of the spray gun (b) Types of solvents used to clean the spray gun (c) Reasons for not using caustic solutions for cleaning (d) Reasons for not immersing complete gun in solvents (e) Importance of using proper methods to clean holes and passages (f) Types and care of packings in gun (g) Proper storage of the spray gun (h) Trade specifications for hoses (i) Pressure drop in relation to length and size of hose (j) Miscellaneous hose fittings
3. Lubricating the spray gun	(a) Purpose of lubrication (b) When and where to lubricate (c) Types of lubricants used
4. Adjusting the spray gun	(a) Type of work to be done (b) Types of materials to be used (c) Sizes of guns (d) Pattern adjustment and its purpose (e) Fluid adjustment and its purpose (f) Effect of air pressure and material visosity on the pattern (g) Faulty patterns, their cause and remedy

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BLOCK 6: General Shop Practice UNIT 2: Power Sanders

OPERATIONS	KNOWLEDGE
1. Sanding with electric flat sanders (a) Oscillating motion (b) Straight line motion	(a) When and where used (b) Types of sandpaper used (c) Grade or number of sandpaper used (d) Procedure to cut and break sandpaper sheets to fit sander pad (e) Types and sizes of sander pads (f) Methods of holding sandpaper to the pad (g) Speed of sander (h) Care and lubrication of sander (i) Need for grounding the sander (j) Types and methods of lubrication (k) Hand Pressure needed (l) Chrome and trim protection (m) Method of cleaning sander filter (n) Hazards in using liquids
2. Sanding with air driven flat sander (a) Oscillating motion (b) Straight line motion	(a) When and where used to best advantage (b) Types of sanders (c) Types of abrasives used and backing (d) Air pressures and their effect on speed (e) Types of fasteners for sandpaper (f) Types and sizes of sandpaper pads (g) Necessity for protecting chrome, glass, etc. (h) Care and lubrication of sander (i) When to use water as a lubricant for sandpaper
3. Sanding with a disc sander	(a) Types and speeds of disc sanders (b) Types and sizes of pads (c) Special adapter pads for feather-edging (d) Types and grits of discs (e) Need for grounding the sander (f) Proper movement of sander (g) Necessity of proper hand pressure (h) Eye protection (i) Care and lubrication of the sander

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BLOCK 6: General Shop Practice UNIT 3: Air Supply

OPERATIONS	KNOWLEDGE
1. Maintaining the air compressor and tank	(a) Purpose of the compressor (b) Types of compressors (c) Capacity of compressor (d) Types of lubricants used (e) Where and when to lubricate (f) Proper location for compressor (g) Where and when to drain water from air storage tank (h) Automatic cut-off switch (i) Proper belt tension (j) Procedure in cleaning air intake filter (k) Proper pipe size to carry air supply from compressor
2. Cleaning the air transformer	(a) Purpose of the transformer (b) Types of transformers (c) Principal parts (d) Location of the transformer in relation to compressor (e) Need for cleaning (f) When and where to drain moisture from transformer (g) Causes and remedies for drop in pressures (h) Pressure adjustments

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BLOCK 6: General Shop Practice UNIT 4: Protective Coverings

OPERATIONS	KNOWLEDGE
1. Masking with tape	(a) Types and materials used (b) Sizes as to width (c) Special heat resistant tapes (d) Need for clean surfaces for adhesion (e) Proper application of tape on corners (f) Proper method of breaking or tearing tape (g) Proper time to install and remove tape (h) Proper storage and shelf life of tape (i) Where to use tape
2. Masking with tape and paper	(a) Where and when needed (b) Procedure of cutting and folding the paper to proper sizes (c) Disadvantages of newspaper (d) Necessity of pleats for curved surfaces (e) Use of paper bags to cover mirrors, spotlamps, etc. (f) Economy in the use of narrow strips
3. Using the apron tape masking machine	(a) Types of machines available (b) Widths of tape and paper needed (c) Economy for type jobs (d) Tape and paper cutter bar (e) Use of pleats for curved work (f) Procedure to install the tape and paper on the machine (g) Lubrication of rollers on machine
4. Masking with water soluble compounds	(a) Types of compounds and composition (b) Methods of keeping prepared surfaces free of compounds (c) Methods of application and removal (d) When and where to use
5. Masking with plastic covers	(a) Types of plastics (b) Shapes of covers (c) Methods of holding in place (d) Necessity of cleaning

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BLOCK 6: General Shop Practice UNIT 5: The Spray Booth

OPERATIONS	KNOWLEDGE
1. Heating the spray booth	(a) Hazard of open flames (b) Types of spray room heating equipment (c) Correct spray room temperature (d) Use of automatic controls (e) Importance of clean equipment for safety and quality work
2. Baking paint finishes with infra-red heat lamps (a) Portable units (b) Bake ovens	(a) Types of lamps and reflectors (b) Purpose and advantages (c) Proper distance for different materials (d) Proper voltages (e) Use of automatic shut-off devices (f) Different rates of drying (g) Procedures in cleaning and caring for lamps and reflectors (h) Effect of heat on different colours (i) Need for covers while spraying (j) Proper ventilation while lamps are on (k) Lubrication of travelling units
3. Cleaning and maintaining the exhaust fan	(a) Purpose and location of exhaust fan (b) Types of exhaust fans (c) Capacity in relation to room size (d) Materials and methods to clean fan and motor (e) Need for sealed electric motors (f) Lubrication
4. Cleaning spray room filters	(a) Need for filters (b) Size and location of filters (c) Materials used in filters (d) Methods used to clean filters (e) Necessity of replacing filters
5. Cleaning spray room lights	(a) Need for vapour proof lights and switches (b) Importance of keeping lights clean for safety and efficiency (c) Materials and methods for cleaning

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BLOCK 6: General Shop Practice UNIT 6: Clips and Fastening for Chrome Trim

OPERATIONS	KNOWLEDGE
1. Removing and replacing chrome name plates	(a) Types of clips, speed nuts, and fastenings (b) Necessity for removal (c) Use of special tools (d) Proper procedure to prevent damage (e) Necessity to replace used speed nuts
2. Removing and replacing headlamp and tail-lamp doors and chrome mouldings	(a) Types of clips, T-Bolts and fastenings (b) Special treatment for rusted bolts and nuts (c) When to remove instead of masking (d) Proper procedure to prevent damage (e) Hand tools required
3. Sealing holes for clips and fasteners	(a) Necessity for sealing (b) Where and when to apply sealer (c) Types of sealing compounds (d) Use of solvents to clean excess sealer from finish
4. Storing and tagging chrome trim parts	(a) Necessity for holding clips and fastenings in place with masking tape (b) Necessity to tag and identify parts (c) Importance of protecting from damage

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BLOCK 6: General Shop Practice UNIT 7: Respirators

OPERATIONS	KNOWLEDGE
1. Using the respirator	(a) Types of respirators (b) Types of respirator retainer straps and fastenings (c) Types of filters (d) Necessity of wearing a respirator (e) Necessity of a good fit
2. Cleaning the respirator	(a) Methods of replacing filter pads (b) Need for keeping exhaling valves free (c) Precaution against using solvents on rubber parts (d) Use of soap and water (e) Proper storage (f) Types and use of disinfectant

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BLOCK 6: General Shop Practice UNIT 8: Paint Brushes

OPERATIONS	KNOWLEDGE
1. Using the paint brush	(a) Types of brushes (b) Use of special shapes and sizes (c) Bristle materials (d) Proper stroke and angle
2. Cleaning the brush	(a) Types of solvents (b) Use of soap or detergent (c) Necessity of support when soaking (d) Methods of shaping and oiling

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BLOCK 6: General Shop Practice UNIT 9: Material Containers

OPERATIONS	KNOWLEDGE
1. Opening the container	(a) Types of lids and caps (b) Care necessary in opening (c) Types of tools for removing lids
2. Pouring the material	(a) Label protection (b) Necessity of punching holes in top edge of some containers
3. Closing the container	(a) Necessity of air tight container (b) Necessity of clean rim and lid (c) Methods of displacing oxygen from container (d) Necessity of proper storage cupboards (e) Proper storage temperature

Refinishing - BLOCK 7 - Surface Preparation

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BLOCK 7: Surface Preparation UNIT 1: Preliminary Procedures

OPERATIONS	KNOWLEDGE
1. Washing the outside	(a) Necessity for having the car clean (b) Types of sponges and brushes (c) Types and uses of soaps and detergents (d) Necessity of a dry surface (e) The use of the air blow-gun to dry cracks, crevices, welts and mouldings (f) Special nylon cloth for bug removal
2. Cleaning the inside	(a) Necessity of cleaning the inside, the sills, and the door openings (b) Use and care of the vacuum cleaner (c) Types and sizes of vacuum cleaners (d) Types of air blow-gun (e) Air pressures for blow-gun (f) Use of the blow-gun
3. Removing wax and grease from the old paint	(a) Purpose of removing foreign matter (b) Effects of wax and grease on the new paint (c) Types of wax and grease removing solvents (d) Procedures in using solvents (e) When to remove wax or grease (f) Advantage of clean white cloths
4. Cleaning the engine compartment	(a) Necessity of cleaning (b) Types of solvents and cleaners (c) Types of soaps and detergents (d) Use of hot water and air pressure (e) Necessity of drying after washing (f) Methods of drying

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BLOCK 7: Surface Preparation — UNIT 2: Inspection of Old Paint Film

OPERATIONS	KNOWLEDGE
1. Testing for type of paint	(a) Advantage of knowing the type of finish (b) Types of finish possible (c) Action of lacquer thinner on different finishes
2. Checking for defects in the old film	(a) Types of paint failures and defects (b) Advantage of using a magnifying glass (c) Procedures in dealing with various defects
3. Testing film for age	(a) Reasons for not painting or polishing a new enamel finish (b) Test for ease of marking (c) Test for ease of dissolving
4. Testing for film thickness	(a) Visual check for film thickness (b) When to paint over the old film (c) When to remove the old paint
5. Testing old paint for adhesion	(a) Importance of adhesion (b) Use of a putty knife or scraper (c) Use of masking tape to test adhesion

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BLOCK 7: Surface Preparation — UNIT 3: Old Paint Finish (Condition Good)

OPERATIONS	KNOWLEDGE
1. Sanding old paint surface (a) Lacquer (b) Enamel	(a) Necessity of sanding (b) Types of sandpaper (c) Grade of sandpaper (d) Necessity of knowing finish types (e) Importance of proper direction (f) Amount of sanding needed (g) Need for water sanding (h) Disadvantages of dry sanding (i) Results of finger sanding (j) Proper hand pressures (k) Proper methods of folding and holding paper sheets
2. Cleaning up after sanding	(a) Necessity of re-cleaning the surface (b) Use of sponge and chamois (c) Use of solvent (d) Types of solvent which do not soften old paint (e) Necessity of using the blow-gun (f) Advantage of clean cloths (g) Necessity of keeping bare hands off the surface
3. Removing lint and dust	(a) Necessity of blowing with air (b) Advantage of wiping with a tack-rag (c) Methods of making tack-rags (d) Types of tack-rag varnish (e) Proper storage of tack-rags (f) Necessity of grounding the car to prevent static electricity

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BLOCK 7: Surface Preparation — UNIT 4: Old Paint Finish (Condition Poor)

OPERATIONS	KNOWLEDGE
1. Scraping off the old paint finish	(a) Types of scrapers (b) Necessity of sanding after scraping (c) Proper hand pressures (d) Direction of motion (e) Why metal must not be marred
2. Removing paint with solvent solutions	(a) Types of solutions (b) Necessity of good ventilation (c) Time required to dissolve various paints (d) Methods of removing softened paint (e) Necessity of neutralizing (f) Disadvantages of solutions containing wax (g) Necessity of removing body trim parts (h) Necessity of cleaning cracks and crevices (i) Safety and health precautions against toxic vapours (j) Results of using caustic solutions on aluminum, zinc or wood
3. Removing paint with a disc sander	(a) Types of discs (b) Grade of discs (c) Sizes of discs and their effect on speed (d) Advantage of hexagon shaped discs for concave surfaces (e) Care of chrome trim parts (f) Possibility undercutting soldered areas (g) Types and sizes of disc pads (h) Necessity of hand sanding after grinding

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BLOCK 7: Surface Preparation

UNIT 5: Bare Metal (Ferrous and Non-Ferrous)

OPERATIONS	KNOWLEDGE
1. Sanding bare metal (a) Power sanding (b) Hand sanding	(a) Types of abrasives (b) Grade of abrasives (c) Metal identification (d) Procedures on soft non-ferrous metals (e) Necessity of sanding (f) Direction of motion
2. Cleaning bare metal	(a) Necessity of having metal chemically clean (b) Necessity of removing scale (c) Special solutions for non-ferrous metals (d) Necessity of removing rust (e) Reasons for not using "fuel" gasoline (f) Special rust removers and inhibitors (g) Results of touching surface with bare hands (h) Advantage of priming metal immediately after cleaning
3. Drying bare metal	(a) Use of the blow-gun (b) Advantage of clean cloths (c) Care to insure proper drying around mouldings, welts, cracks and crevices

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BLOCK 7: Surface Preparation UNIT 6: Silicone Polish

OPERATIONS	KNOWLEDGE
1. Detecting silicone polishes	(a) Nature of silicone (b) Value of trial coat of enamel on small area (c) Where to make a test
2. Removing silicone polish	(a) Special solvents needed (b) Reasons for doing small areas at a time (c) Necessity for wiping dry (d) Advantage of clean cloths (e) Necessity for disposing of cloths after use

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BLOCK 7: Surface Preparation UNIT 7: Broken Paint Edges

OPERATIONS	KNOWLEDGE
1. Featheredging the paint film (a) By hand (b) By power machine	(a) Necessity of tapering the paint edge (b) Types of sanders and adapters (c) Grade and types of sandpapers used (d) Amount of tapering necessary
2. Backsanding beyond the tapered edge	(a) Types of sandpaper (b) Grades of sandpaper to use on various finishes (c) Use of water with sandpaper (d) Necessity of backsanding

Refinishing - BLOCK 8 - Undercoats

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BLOCK 8: Undercoats

UNIT 1: Metal Primers

OPERATIONS	KNOWLEDGE
1. Reducing primer for spraying	(a) Types of primers (b) Advantage of special primer for some metals (c) Compatible thinners and reducers (d) Amount of reduction needed
2. Applying primer	(a) Air pressures needed (b) When to use primers (c) Where to use primers (d) Purpose of primers (e) Film thickness required
3. Preparing primer	(a) Necessity of sufficient drying time (b) Need for scuffing lightly with sand paper

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BLOCK 8: Undercoats UNIT 2: Surfacers

OPERATIONS	KNOWLEDGE
1. Reducing surfacer for spraying	(a) Types of surfacers (b) Types of thinner or reducer (c) Necessity of proper stirring for uniformity (d) Purpose of surfacer (e) Proper viscosity
2. Applying surfacer	(a) Air pressures needed (b) Film thickness (c) Proper drying between coats and before sanding (d) Purpose and advantage of different coloured surfacers (e) Results of applying on bare metal (f) Necessity of full wet coats (g) Results of forced drying with air
3. Sanding surfacer	(a) Types and grades of sandpaper (b) Necessity of sanding (c) Amount of sanding needed

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BLOCK 8: Undercoats

UNIT 3: Putties

OPERATIONS	KNOWLEDGE
1. Applying putty	(a) Types of putty (b) Advantage of thin coats (c) Proper drying between coats and before sanding (d) Use of a glazing knife (e) Use of a rubber squeegee (f) Precaution against application on bare metal (g) Materials for thinning putty (h) Steps in reducing hardened putty
2. Sanding putty	(a) Types and grades of sandpapers (b) Advantage of a sanding block

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BLOCK 8: Undercoats

UNIT 4: Primer-Surfacer

OPERATIONS	KNOWLEDGE
1. Reducing primer-surfacer	(a) Types of primer-surfacer (b) Types of solvents needed for reduction (c) Importance of thorough mixing for uniformity (d) Proper viscosity
2. Applying primer-surfacer	(a) Proper air pressures (b) Proper film thickness (c) Flash time between coats (d) Advantage of different coloured primer-surfacers (e) Causes of porous coatings (f) Disadvantages of forced drying with air
3. Sanding primer-surfacer	(a) Types and grades of sandpaper (b) Thorough drying before sanding (c) Need for sanding

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BLOCK 8: Undercoats

UNIT 5: Bleeder Sealer

OPERATIONS	KNOWLEDGE
1. Reducing to proper viscosity	(a) Purpose of bleeder sealer (b) Advantages of proper thinner (c) Proper amount of reduction
2. Applying bleeder sealer	(a) Air pressure required (b) Advantage of two full wet coats (c) Disadvantage of sanding (d) Need for primer-surfacer before applying colour coats (e) Disadvantages of forced drying

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BLOCK 8: Undercoats UNIT 6: Primer Sealer

OPERATIONS	KNOWLEDTE
1. Reducing primer sealer	(a) Purpose of primer sealer (b) Types available (c) Colours available (d) Types of thinners and reducers (e) Necessity of reduction
2. Applying primer sealer	(a) Air pressures necessary (b) Necessity of a full wet coat and proper drying (c) Use of different colours as ground coats
3. Removing nibs and dust particles	(a) Results of sanding (b) Advantages of using a tack-rag

Refinishing - BLOCK 9 - Colour Coats and Decorative Features

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BLOCK 9: Colour Coats and Decorative Features

UNIT 1: Enamel Colours

OPERATIONS	KNOWLEDGE
1. Reducing enamel for spraying	(a) Types of reducers and catalyst (b) Proper amount of reduction needed (c) Effect of paint temperature on viscosity (d) Necessity of proper stirring (e) Viscosity and its effect on the final film (f) Purpose and methods of straining paint
2. Applying enamel colours	(a) Spray gun technique (b) Types of patterns required (c) Spray gun adjustments for material and for pattern (d) Air pressures and their effect (e) Necessity of painting complete panels (f) Proper sequence to follow on a complete repaint job (g) Manufacturers' recommendations regarding number of coats and procedures of applying certain materials (h) Prevention of dust (i) Recommended film thickness (j) Proper time between coats (k) Necessity of cross coating (l) Paint problems, their cause and remedy
3. Heating enamels for hotspray	(a) Purpose of heating enamel (b) Equipment for heating enamel (c) Proper temperature and its effect on viscosity (d) Additives to prevent wrinkling (e) Use and care of thermometer (f) Advantages and disadvantages of hotspray

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BLOCK 9: Colour Coats and Decorative Features

UNIT 2: Lacquer Colours

OPERATIONS	KNOWLEDGE
1. Thinning lacquer for spraying	(a) Types of thinners (b) Proper viscosity (c) When to use retarder (d) Necessity of proper mixing (e) Methods and necessity of straining materials
2. Spraying lacquers	(a) Proper air pressures (b) Film thickness and number of coats needed (c) Proper gun manipulation (d) Advantage of mist coats (e) Proper time between coats (f) Necessity of full wet coats (g) Spray gun adjustments (h) Paint problems and remedies
3. Touching up with lacquers	(a) Proper gun manipulation for blending (b) Mist coating techniques (c) Effect of air pressure on final colour
4. Polishing lacquers (a) Hand polishing (b) Machine polishing	(a) Necessity of compounding (b) Necessity of proper drying time before compounding (c) Direction of motion (d) Types of cloths and machine pads (e) Types of polishing machines (f) Procedures for installing buffer pads (g) Necessity and methods of cleaning buffer pads (h) Possibility of cut-through (i) Types and purpose of waxes and polishes

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UNIT 3: Metallic Base Colours

OPERATIONS	KNOWLEDGE
1. Applying metallic base colours	(a) Effect of air pressure on the final colour (b) Effect of gun distance on final colour (c) Effects of flooding the film (d) Effect of wet and dry coats on the colour (e) Necessity of mist coats (f) Disadvantages of hotspray method (g) Effect on final colour of film thickness (h) Maximum and minimum thicknesses of all coats on new cars

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BLOCK 9: Colour Coats and Decorative Features

UNIT 4: Colour Matching

OPERATIONS	KNOWLEDGE
1. Intermixing colours to formula	(a) Colours available (b) Methods and necessity of thorough agitating (c) Methods of formulating by weight or volume (d) Procedures for intermixing (e) Colour identification from code numbers (f) Where to find the paint code on the vehicle (g) Mathematics to determine weight and volume (h) Reasons for not thinning before intermixing (i) Difference between mixing colours and ready to use colours (j) Necessity of keeping paint cans sealed (k) Manufacturers' specifications for driers
2. Tinting to match a specific colour	(a) Necessity of proper colours for tinting (b) Behaviour of tinting colours (c) Mass tones (d) Tinting tones (e) Colour perception (f) Colour characteristics (g) Importance of proper day-light (h) Glossary of trade terms (i) Paint components (j) Simple chemistry of oils, paints, pigments, resins and solvents (k) Fading and chalking (l) Methods and procedures for comparing colours

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BLOCK 9: Colour Coats and Decorative Features

UNIT 5: Final Procedure

OPERATIONS	KNOWLEDGE
1. Cleaning the vehicle after colour coats	(a) Methods and procedures for cleaning glass (b) Methods and procedures for cleaning and protecting chrome (c) Steps to protect paint (d) Tire dressings and their application (e) Methods and procedure for removing overspray (f) Effect of harmful solvents on plastic trim (g) Advice to the customer on washing and polishing (h) Identification and recording of new colour
2. Striping (a) By brush (b) By wheel	(a) Paint materials used (b) Desirable viscosity and reducers (c) Colour harmony (d) Types of brushes (e) Types of wheel machines and wheel widths (f) Procedures in filling and cleaning machine (g) Use of guide on machine (h) Techniques of handling brushes and machines
3. Applying decals and transfers	(a) Types of same and nature of backing (b) Necessity of cleaning (c) Necessity of soaking self adhering types (d) Procedures in applying adhesive to panel and decal (e) Prompt removal of excess gum (f) Methods of removing wrinkles and air bubbles (g) Required drying time for varnish (h) Necessity of wetting with water

Refinishing - BLOCK 10 - Care of Body Finish

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BLOCK 10: Care of Body Finish UNIT 1: Stains and Foreign Matter

OPERATIONS	KNOWLEDGE
1. Removing stains from finish	(a) Identification of stains (b) Types of cleaners and solvents (c) Care necessary to preserve finish
2. Cleaning the old finish	(a) Identification of finish (b) Use of fine abrasive compounds (c) Types of detergents and wetting agents (d) Proper washing procedures (e) Reasons for not using alkaline soaps (f) Types of wax removing solvents (g) Necessity of removing dead paint film
3. Polishing the old finish	(a) Necessity of protective polishes (b) Types of silicone or wax polishes (c) Procedures for application of polishes (d) Types of rubber dressings and methods of application

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BLOCK 10: Care of Body Finish — UNIT 2: Chips and Scratches

OPERATIONS	KNOWLEDGE
1. Preparing the surface	(a) Importance of a clean surface (b) Procedures for removing loose paint (c) Methods of cleaning
2. Touching up by brush	(a) Identification of colours (b) Types of touch-up paint (c) Types of brushes (d) Procedures used to build up the surface
3. Touching up by spray gun	Refer to Block 9, Unit 2, Operation 3